



## Yeast Cell Factories for Production of Fuels and Chemicals

**Borodina, Irina; Zhao, Zongbao Kent**

*Published in:*  
FEMS Yeast Research

*Link to article, DOI:*  
[10.1093/femsyr/fox082](https://doi.org/10.1093/femsyr/fox082)

*Publication date:*  
2017

*Document Version*  
Peer reviewed version

[Link back to DTU Orbit](#)

*Citation (APA):*  
Borodina, I., & Zhao, Z. K. (2017). Yeast Cell Factories for Production of Fuels and Chemicals. *FEMS Yeast Research*, 17(8), [fox082]. <https://doi.org/10.1093/femsyr/fox082>

---

### General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Special issue

## **Yeast Cell Factories for Production of Fuels and Chemicals**

*Irina Borodina<sup>1</sup> and Zongbao Kent Zhao<sup>2</sup>*

<sup>1</sup> The Novo Nordisk Foundation Center for Biosustainability, Technical University of Denmark, Denmark

Irina Borodina <[irbo@biosustain.dtu.dk](mailto:irbo@biosustain.dtu.dk)>;

<sup>2</sup> Division of Biotechnology, Dalian Institute of Chemical Physics, CAS Zhaozb <[zhaozb@dicp.ac.cn](mailto:zhaozb@dicp.ac.cn)>

What's yeast got to do with jet fuel, perfume, and antibodies? A lot, actually. Engineered yeast cells can produce all these and much more in a fermentation using renewable feedstocks.

The engineering of yeasts has become cheaper and faster, particularly due to the progresses in DNA sequencing and gene synthesis and genome-editing technologies. Now, the scientists can rapidly construct multiple synthetic pathways towards heterologous products and engineer the yeast metabolism to divert the carbon flux towards the product. Metabolic engineers are no longer limited to intuitive guesses on which genetic modifications would improve the cellular performance, but they can tap into the vast systems-level data and rely on detailed genome-scale metabolic models to identify the genetic targets. The low cost of genome sequencing encouraged the efforts on deciphering and engineered tolerance towards stress factors in industrial fermentations. The combinations of these aspects facilitated the emergence of novel commercial processes that utilize genetically engineered yeasts as cell factories to produce 2<sup>nd</sup> generation biofuels, isoprenoids, aromatics, and recombinant proteins.

This special issue of FEMS Yeast Research includes

([https://academic.oup.com/femsyr/pages/yeast\\_cell\\_factories](https://academic.oup.com/femsyr/pages/yeast_cell_factories)) 11 mini-reviews from the leaders in the field on the recent advances in metabolic engineering and synthetic biology of yeast.

The applications of CRISPR for genome editing of yeasts are summarized in (Stovicek et al 2017). Construction and applications of biosensors for monitoring and controlling the cellular metabolism are described in (-D'Ambrosio and Jensen 2017).

(Lopes and Rocha 2017) gives a perspective on how genome-scale modeling supports computer-design of cell factories. The application of systems biology data to understand and improve recombinant proteins production in *Pichia pastoris* is described by (Zahrl et al 2017).

The technology for production of bioethanol from lignocellulosic feedstocks has been on the way for the past two decades, overcoming many hurdles, as the lack of C5-sugars utilization in *Saccharomyces cerevisiae* and sensitivity to inhibitors in biomass hydrolyzates. The review by (Jansen et al 2017) describes the key technological breakthroughs that enabled the first commercial-scale 2<sup>nd</sup> generation bioethanol plants. A detailed summary on xylose utilization can be found in ( Hou et al. 2017). ( -Deparis et al 2017) describe how tolerance towards industrial stress factors can be engineered in yeast cell factories. (Hara et al 2017) look into the 3<sup>rd</sup> generation biorefineries with consolidated bioprocessing, where yeast cell factories have a capacity for biomass hydrolysis and the expensive enzymatic hydrolysis step can be avoided.

Finally, the issue features reviews on metabolic engineering advances for production of various classes of industrially important chemicals: fatty-acid-derived metabolites (Fernandez-Moya and Da Silva 2017), isoprenoids (Zhang et al. 2017), and aromatic compounds (Gottardi et al. 2017).

We thank all the authors for their contributions and the reviewers for kind comments and suggestions. We hope that scientists from both academy and industry will enjoy reading these mini-reviews and will find them useful and inspiring.

## References

Stovicek et al *FEMS Yeast Research*, Volume 17, Issue 5, 1 August 2017, fox030,  
<https://doi.org/10.1093/femsyr/fox030>

D'Ambrosio and Jensen 2017 <https://doi.org/10.1093/femsyr/fox076>

Lopes and Rocha 2017 *FEMS Yeast Research*, Volume 17, Issue 5, 1 August 2017, fox050,  
<https://doi.org/10.1093/femsyr/fox050>

Zahrl et al 2017 *FEMS Yeast Research*, fox068, <https://doi.org/10.1093/femsyr/fox068>

Jansen et al 2017 *FEMS Yeast Research*, Volume 17, Issue 5, 1 August 2017, fox044,  
<https://doi.org/10.1093/femsyr/fox044>

Hou et al. 2017 *FEMS Yeast Research*, Volume 17, Issue 4, 1 June 2017, fox034,  
<https://doi.org/10.1093/femsyr/fox034>

Deparis et al 2017 *FEMS Yeast Research*, Volume 17, Issue 4, 1 June 2017, fox036,  
<https://doi.org/10.1093/femsyr/fox036>

Hara et al 2017 *FEMS Yeast Research*, fox061, <https://doi.org/10.1093/femsyr/fox061>

Fernandez-Moya and Da Silva 2017 <https://doi.org/10.1093/femsyr/fox071>

Zhang et al. 2017 (**FEMSYR-17-06-0097.R1**)

Gottardi et al. 2017 *FEMS Yeast Research*, Volume 17, Issue 4, 1 June 2017, fox035,  
<https://doi.org/10.1093/femsyr/fox035>